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TRENDS IN INFORMATION HANDLING IN THE UNITED STATES

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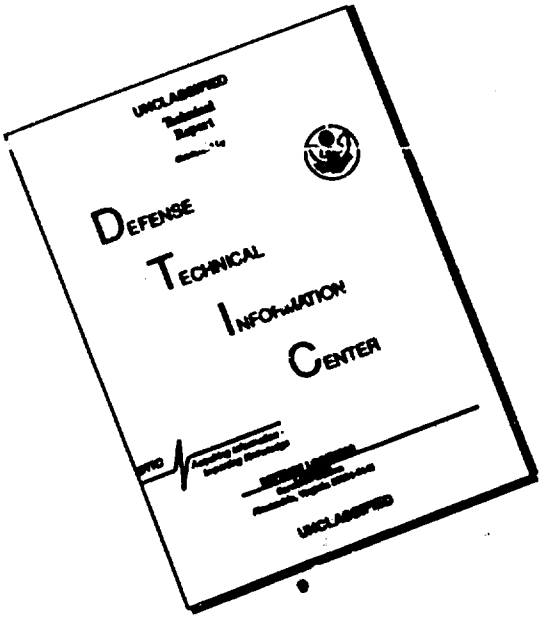

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TRENDS IN INFORMATION HANDLING IN THE UNITED STATES

PREFACE

This paper is an attempt to respond to a request for a summary of current trends in information handling work in the United States of America.

The paper is not encyclopedic, even for the audience for which it has been written, people who process scientific and technical information. Time and the author's interests have limited this examination to the development of information products for user groups and to network arrangements that are expected to result in processing efficiencies. Annual reviews such as Advances in Computers[1] and the Annual Review of Information Science and Technology[2] collectively, if not individually, reflect the broad scope of activities that contribute to the total information handling enterprise. Other sources for current trends are the proceedings of various professional societies (e.g., American Society for Information Science, Association for Computing Machinery) and of other annual events (e.g., the Spring and Fall Joint Computer Conferences, the Annual National Information Retrieval Colloquium).

Two aspects of information handling work outside the scope of this paper are mentioned here because they are rarely discussed. They are, it is hoped, not trends but transitory phenomena. One is the parochial attitude of many information-handling practitioners. The other concerns potentially detrimental effects of the universality that exists for information.

Information handling activities are widespread in business, industry, and government as well as in science. However, there appears

to be little transfer of knowledge gained in one sector to another. By accident or preference, individuals seem to choose an area for specialization and restrict their attention to it. One wonders, for example, whether principles of classification and indexing developed for handling scientific information might be applicable to the organization and retrieval of information from correspondence and technical files in industry. Can this be tested if industrial system designers are not conversant with these principles and scientific information workers consider this body of information outside their purview? Might industrial data management and inventory scheduling programs be applicable to strategies for information storage and retrieval and document collections? Without collaborative study by workers in both sectors, potentially valuable programs will remain unexplored. If lack of knowledge and timely information prevent the general public from understanding such matters as social issues and the relevance of science to economic well-being, might techniques used in designing and disseminating information products for the scientific community be adaptable to public audiences? Who will investigate this? Might the networking efforts discussed in this paper be aided by procedures developed for sharing information within multi-plant industries?

Parochialism may be a characteristic of individuals who are self-taught and on-the-job trained. Curricula are gradually emerging, such as the Masters' program in Information Science at the University of California, Los Angeles,[3] that will give individuals breadth of knowledge and flexibility of thought. However, academic programs will not satisfy the volume of present needs and those of the near future. The spirit that moved today's information specialists to leave more

traditional fields for information handling may be dormant but, presumably, is not dead. It should now be reawakened so that knowledge, wherever acquired, can be brought to bear on problems wherever they arise.

Universality of interest in fields such as health and human behavior has tended to instill in the layman an illusion of knowledge that has led to armchair opinions and even pressure groups for or against the scientific work of specialists. Since information is a commodity that almost everyone needs and uses, and, through computerized systems, news media, etc., people are becoming accustomed to inundation, it may be anticipated that lay opinions will soon be propounded that could interfere with professional activities. This has already occurred in science and business where users have instituted (and become dissatisfied with) systems in disregard of information handling principles, experience, and know-how that at least positively bias undertakings toward success.

Several devices, such as educational television, science articles in newspapers and popular magazines, and continuing education courses are being employed to bring an appreciation of science, technology, and social issues to the public. Some popularization of information work has also appeared, principally about medical and law enforcement systems. More of this needs to be done to convey not only accomplishments but also limitations and problem areas to explain, for example, what causes erroneous billings and why stylized language must be used. Acceptance and support of the work of specialists by non-specialist users are likely to increasingly depend on the extent to which specialists can induce appreciation and understanding in the minds of the

users. Those who handle information may be among the best equipped of specialists for this new and challenging application of information handling, education of the layman for his own benefit.

THE INFORMATION HANDLING MILIEU

An overview of the United States Government's investment in information handling is reported annually by the National Science Foundation (NSF).[4] Figures 1, 2, and 3 show the growth in this investment and how funds have been distributed within the Federal agencies and within various categories of activity. It should be noted that these funds pertain only to the area of scientific and technical information and, though they represent the budgets of 23 Federal agencies and departments, it is believed that they exclude funds expended on information handling incidental to programs that do not report information work as a separate element. The tabulated data also do not include Government support for the collection of general-purpose scientific data. Separately accounted, this expenditure is shown in Figures 4 and 5.

A limited survey of information handling in private firms suggests little investment that has not been Government stimulated other than bare essentials needed for minimal library services for professional staffs.[5] With the exception of such landmark projects as that of the Chemical Abstracts Service (partially Government sponsored), professional societies have only recently begun to assess their information handling mechanisms and to explore new processing techniques and new dissemination devices. A significant current trend is the appearance of commercially produced publications and services that

frequently offer little new substantive content over that already available from other sources, but the packaging is designed for higher user acceptability.

The information handling milieu was deemed by the NSF to be sufficiently complex to warrant an evaluative study. The study, conducted by a National Academy of Sciences - National Academy of Engineering committee (known as the SATCOM Committee), contains 55 recommendations including one for the formation of a continuing body for policy planning and guidance.[6] The Committee underscored the joint responsibility of the public and private sectors for the management of information and advocates the development of many different types of information products (called "third-level services") to meet different types of requirements for information.

The knowledge and experience that have been accumulated in the United States are exemplified in the practices and approaches that are described below. These reflect the attainment of sufficient maturation to make possible a more advanced level of research into information handling that could include not only studies of system designs and hardware configurations but also of human information processing capabilities. The present spectre of reduced funds for research seems to be threatening at an important juncture in the development of this field as a science. Perhaps popularization discussed above can reverse this trend.

SPECIALIZED INFORMATION PRODUCTS

A dictum among information specialists who have been operating customized information services is: the better the service, the more sophisticated and precise the user becomes in specifying his needs.

This has been the experience of the Aerospace Research Applications Center (ARAC) located at Indiana University. Since some of ARAC's products are typical of those being developed at other facilities, and some represent responses to user need illustrative of the above dictum, they are described here at some length.[7]

ARAC's principal product is called the Standard Interest Profile. Each Profile characterizes a subject area that ARAC has found, through interaction with users, adequately delineates a field of interest that is sufficiently comprehensive to serve a group of users but sufficiently specific to exclude extraneous topics. About 80 Profiles have been identified. Bulletins are issued for each Profile that announce, via abstracts, the existence of new papers and reports as they appear in the literature. The bulletins repackage abstracts that are contained in five Government-sponsored abstracting journals: National Aeronautics and Space Administration's (NASA) Scientific and Technical Aerospace Reports, NASA-sponsored International Aerospace Abstracts, Department of Commerce's U.S. Government Research and Development Reports, Atomic Energy Commission's Nuclear Science Abstracts, and NASA's Aerospace Medicine and Biology. In 1969, ARAC enlarged its coverage to include the contents of Engineering Index (EI), but volume as well as topic area, economics, and clientele dictated that Profile bulletins from EI be issued separately. Bulletins of this nature are often referred to as "current awareness services."

Based on experience, i.e., on feedback, i.e., on interactions that have educated both ARAC's information personnel and ARAC's users, ARAC has modified and expanded several of its Profiles. That pertaining to Computer Information, for example, includes announcements of computer programs selected for the generality of their applications and the completeness of their documentation. Announced programs and documentation are available from ARAC at a modest cost. The Profile for Operations Research is augmented by notations of contents of leading journals in this topic area that include not only bibliographic information but also lists of references cited in the papers and, occasionally, a brief annotation. The Profile for Marketing Information presents monthly comprehensive abstracts for about ten papers screened from a review of about seventy journals; it is directed mainly to marketing executives and analysts. The Profile for Management Information is also pared to a few items, with special attention to sources that practicing managers are not expected to be familiar with and to papers that are well written, timely, and will help broaden the user's knowledge of management practice.

ARAC also offers Custom Interest Profiles that are tailored to individual, as distinguished from group, topic areas. Experience has shown that most users are satisfied with the less expensive Standard Profiles.

Another variation of the specialized abstract bulletin is ARAC's weekly Industrial Applications package. It announces eight to ten reports of results and innovations that appear particularly suitable for application in non-defense, non-aerospace industries. The package includes all NASA Tech Briefs issued during the period as

attachments. The coverage spans various technical areas.

ARAC exploits its information resources through another popular product, its Retrospective Search package. This is primarily a presentation of abstracts of reports and articles judged by an ARAC subject specialist as appropriate to a user's request. The ARAC search procedure usually includes at least one telephone conversation between the searcher and the requester to establish a "meeting of the minds." It can include investigation of information resources beyond those of ARAC and discussions with non-ARAC experts. A letter outlining the sources searched and contacts with experts, and an evaluation form, are part of the package submitted to the customer.

ARAC's 1969 charges for these products are given in Figure 6. ARAC has been in operation since 1962 when it was established as the first of NASA's Regional Dissemination Centers that were designed to promote the transfer to industry and universities of information generated under NASA sponsorship. ARAC found it necessary to expand its scope of coverage beyond NASA's information resources to adequately serve users, but initial NASA support during formative years was undeniably instrumental in giving ARAC the time to experimentally identify appropriate information products.

Many university groups and private firms are beginning to take advantage of the availability on magnetic tape of bibliographic data, subject terms, and abstracts for large volumes of the scientific literature. A large variety of products is offered, for example, by Information Interscience, Inc. (3i) from a data base that includes the files produced by the Excerpta Medica Foundation, Chemical Abstracts

Service, and Engineering Index, as well as those generated by 3i's professional staff.[8] The products include current awareness bulletins that are computer printouts covering requested fields of interest; computer printout indexes for manual searching by customers; tailored computer printout abstract journals; thesauri to aid customers in developing data banks and formulating search questions; computer printed information cards that alert users to the existence of new papers in accordance with special-interest profiles; newsletters that briefly summarize selections from current information in specific subject areas; microfilm aperture cards that include the source document in the microfilm window; and retrospective bibliographies. 3i also provides a computer terminal service that gives clients direct access to the data bases. Fees for scanning the secondary-service data bases are given in Figure 7. University data bases are likely to be less extensive than that of 3i. University groups seem to be planning only products such as current awareness bulletins and retrospective bibliographies that can be generated by computer without content enrichment or vocabulary augmentation or modification.

Several innovations in information packaging are the products of another private firm, the Institute for Scientific Information (ISI). ISI's pioneering Current Contents publication faltered in 1953 for lack of customers but found a market on a third try in 1958. Current Contents reproduces the contents pages of journals judged to be the most important in particular fields. Seven editions are now available, for Life Sciences; Physical Sciences; Chemical Sciences; Education; Agriculture, Food and Veterinary Sciences; Behavioral, Social and Management Sciences; and Engineering and Technology. ISI initiated the

Science Citation Index with 1961 literature. The Index relates published papers with the references cited in them through their respective bibliographic data. The data base has been used since 1965 for a selective dissemination of information (SDI) package called ASCA (Automatic Subject Citation Alert). ASCA reports furnish only bibliographic information, but ASCA computer programs permit specialized selections to be made on a variety of information elements including words, phrases, and word stems; authors' names; organizational sources; journal sources; particular paper, book, and patent citations; and combinations of these. Current Contents and ASCA are backed by an Original Article Tear Sheet (OATS) service that supplies copies of desired papers. Index Chemicus, introduced in 1960, is a registry and comprehensive information source for new chemical compounds. Each entry contains information on synthesis, molecular formula, and structure as well as an abstract of the paper in which the compound is described.[9]

Both Current Contents and Index Chemicus require that the user be more of his own information specialist than he must be with more restrictive information packages. However, information products of broader scope permit the user to browse. Browsing is known to have value in that it often arouses curiosity and thoughts of relationships and associations that have led to new discoveries and applications. Users, particularly in the sciences, have often expressed a willingness to tolerate more rather than less quantity in their information packages to ensure against information loss. No tradeoffs have yet been ascertained that enable definitive decisions on the most appropriate breadth of coverage for information packages for particular types of

users. Most of today's products are likely to have strong supporters because of differences that exist in user need and in user information-processing characteristics and preferences.

The SATCOM report stressed the need for evaluative and critical reviews in science and technology. Annual reviews, handbooks, and tutorials have long appeared in some fields, but these have usually been prepared by subject experts, not by information specialists. The work of several groups of information specialists suggests roles that information personnel could have in this enterprise. At Battelle Memorial Institute's now discontinued Transducer Information Center, for example, information specialists gained sufficient in-depth knowledge to identify topics in need of survey reports that they wrote and that were used as guides by bench scientists.[10] The Annual Report on Stress series[11] and other foundational works of Dr. Hans Selye, director of the Institute of Experimental Medicine and Surgery at the University of Montreal, incorporate the as yet unusual teamwork of librarians, information specialists, and researcher-authors. The Institute's library and information center are as integral to the total organization as its laboratories. Accessibility to the Institute's information resources for the preparation of comprehensive summaries, reviews, and tutorials has been significantly aided by an Institute-designed, tailor-made classification scheme that permits highly specific subject retrieval.[12] The Annual Review of Information Science and Technology[13] has set a precedent for indirect teamwork between information specialists and authors through providing to authors bibliographies of probably relevant references compiled by the information specialists.

The eight loose-leaf series produced by Auerbach Info, Inc., combine features of the handbook and the critical review. Their scopes and costs are summarized in Figure 8. Auerbach Data Handling Reports, for example, contains detailed evaluative analyses of individual data handling devices and data processing supplies, comparison charts, and special topical reports. Quarterly supplements keep the basic text up-to-date or supersede sections and expand the original coverage. The clarity of the text and the high quality of the Auerbach Reports reflect an acquisition of skill by the information-specialist authors for organizing and presenting information that may be distinct from the subject matter they handle. If this is so, similar products should be developable in other subject areas either by information specialists with subject knowledge or by information specialists in concert with subject specialists.

As was stated at the beginning of this section, its objective was to describe types of products rather than exhaustive enumeration. A listing of products on today's market might suggest that the threat of proliferation is past since proliferation has already occurred. The SATCOM report discounts the threat on the assumption that economic factors will act as controllers. The purchase of information products is becoming an accepted part of the cost of doing business, research, and development. The buyer, confronted by an array of products, each of which serves some of his needs with no single one serving all, may subscribe to several and incorporate the cost in what he sells. This could keep an adequate financial base under many overlapping products. On the other hand, the measure of economic self-sufficiency should not apply to products in subject areas whose populations have information

needs but are too small to support products at prices comparable to those in other areas. It is evident that economics do control in the highly specialized areas from the concentration of product developers on broader, more populated fields. Will self-regulation arise through such cooperative arrangements as are discussed in the next section? Or will information products acquire the aura of other products in the market place, to be advertised like toothpaste and television sets, with the usual proviso of caveat emptor?

COOPERATION AND NETWORKING

Historically, many of today's information facilities, from national libraries and documentation centers to large and small university and company information centers, were established when and where they were needed. Expansion across discipline boundaries and a broadening of subject interests generally have been of recent vintage. Response to customer requests has enlarged the collections of many facilities beyond expectations and has introduced considerable overlap among them. High processing costs are beginning to augur for cooperation to reduce the workload, but the possibilities of using machines for processing and exchange have probably been the prime mover behind current joint ventures and large-scale network studies.

One route toward unification, that has been suggested by cost conscious politicians and others, is a giant merger of all information resources into one large system. Aside from the present physical impracticality of this approach, it seriously jeopardizes the purpose served by individual systems, namely, the ability to provide access to information from a particular point of view. Until full texts of

books and documents can be rapidly machine searched, the conventional practice of human assessment of content and designation of subject index terms must suffice. It is the rule rather than the exception that an item of even ten pages will contain information of possible interest to specialists in several fields. Much of current user dissatisfaction with retrievability from information collections arises because responses are not complete often as a result of practical considerations that impose limits on the number of index terms a system (manual or machine) can handle effectively. Since the orientation for improved information processing must be toward greater rather than less accessibility, a direction other than system compression appears advisable.

Among the many collaborative activities presently being pursued, several that are working alliances among different types of information processors appear very promising. A major alliance is that represented by the National Federation of Science Indexing and Abstracting Services (NFSAIS) formed in 1958 with the financial assistance of the NSF by eight leading abstracting and indexing (A&I) services. Today's eighteen members handle a significant portion of the world's annual output of the scientific and technical literature (see Figure 9).[14] The most valuable contribution that NFSAIS makes is as a focal point for its members and others for the consideration of common problems (including overlap and coverage gaps) and methods of solving them. NFSAIS holds annual meetings and its committees and working groups conduct studies for member services. It publishes a bimonthly newsletter, News from Science Abstracting & Indexing Services, that broadcasts newsworthy items not limited solely to the work of its members.[15] NFSAIS is beginning to sponsor tutorial seminars; two on "Indexing in Perspective"

and "Utilization of Computer Based Services by Libraries and Information Retrieval Systems" were announced for the Spring, 1970. NFSAIS interacts for its membership with international bodies concerned with international information exchange.

The significance of NFSAIS cannot be overstressed. Its members are all private, independent organizations. They have voluntarily agreed to subject themselves to inquiry and criticism. Through NFSAIS, individuals engaged in many different information processing operations in many disciplines are becoming familiar with each other's practices and requirements. Genuine communicative rapport has developed among the members that is a prerequisite for productive collaboration. The NFSAIS forum may have materially facilitated the planned study of the Chemical Abstracts Service, Biological Abstracts, and Engineering Index into overlap and what to do about it. NFSAIS is also strengthening ties with groups abroad. The IEE (Institution of Electrical Engineers) is a member based in England; its abstract publications (see Figure 9) as well as two current-awareness journals, Current Papers in Electrical and Electronics Engineering and Current Papers on Computers and Control, are joint efforts with the Institute of Electrical and Electronics Engineers (U.S.).

About one year old, the Association of Scientific Information Dissemination Centers (ASIDIC) may develop into an organization similar in spirit to NFSAIS. Membership is restricted to processors of two or more machine-readable data bases. Members voted at a March 1970 meeting to preserve the informal structure of ASIDIC and to admit as associate members individuals having common interests with the work of the members. The ASIDIC forum provides an interface between third-level

service groups such as ARAC (discussed above) and secondary-service magnetic tape producers, many of whom are members of NFSAIS. In the main, ASIDIC members have more direct contact with users of information than NFSAIS members. ASIDIC members should thus be able to ascertain the strengths and weaknesses of the machine-readable products that are being developed, both with respect to substantive content for user needs and suitability for machine processing. ASIDIC members are presently investigating problems that are arising because of variances among tape formats, the lack of interchangeability among computer programs, and uncertainties with regard to tape availability and costs.

A third organization, the Information Industry Association (IIA), was formed in 1968 by for-profit companies who market information products and services through the application of new information-handling technologies. Voting members are firms offering commercial services; non-voting members include manufacturers of equipment used in information processing and individuals and partnerships engaged in information work. The founders of IIA envision it as a voice for the industry in public and government circles. Two areas in which IIA has been active pertain to the Copyright Law Revision and proprietary rights, and to the Federal Communication Commission inquiry into the future of CATV and potential services that could be transmitted through a big information pipeline.

Software sharing is the cohesive bond for EIN, the Educational Information Network of EDUCOM (the Interuniversity Communications Council). Co-sponsored by the U.S. Office of Education and NSF, its main undertaking is the EIN Catalog, a publication, updated monthly, that

announces the availability mostly of "user programs" developed by universities and other educational institutions. EIN reviews the programs before publication and can provide backup documentation at a reasonable cost. Since program conversion can be expensive, EIN facilitates arrangements for running programs at the institutions where they were written on data supplied by the user. Institutions that are not members of EDUCOM have potential access to the programs through members. EIN plans to extend its program coverage to additional categories of systems software and remote-access systems. In the wake of recent "unbundling," or separate pricing of hardware and software, EIN has begun a membership drive in cooperation with the Special Interest Group on University Computing Centers (SIGUCC) of the Association for Computing Machinery (ACM) to help institutions obtain software as inexpensively as possible. In the first month (February-March 1970) of this drive, membership jumped from 61 to 75.

EDUCOM itself is an organization conceived to aid institutions of higher learning in applying new information processing techniques and technologies. Formed in 1965 with Kellogg Foundation support, it espouses the precept that the essential role of universities is information processing irrespective or where it occurs -- in teaching, learning, or research, or in libraries and information retrieval systems. Recently, EDUCOM has emphasized applications of computer technology to educational administration. Needs of universities for mechanized management information systems are suggesting an EDUCOM direction toward identifying elements common in such systems for groups of institutions and the design of generalized systems modifiable by a given institution. Through EIN, specialized data processing routines

developed by one institution could be made available to others. About 100 institutions now augment the starting membership of 8.[16]

The information activities in the agencies of the Federal Government are also brought together by a coordinating body, the Committee on Scientific and Technical Information (COSATI) of the Federal Council for Science and Technology. Established in 1962, it was rechartered in 1964 and has sponsored many studies of information-handling problems of scopes applicable to the private as well as the public sector. Its six panels and three task groups are currently investigating operational techniques and systems (Panel One); information sciences technology (Panel Two); education and training (Panel Three); international information activities (Panel Four); management of information activities (Panel Five); information analysis centers (Panel Six); dissemination of information (Task Group One); technology utilization (TG Two); and national systems for scientific and technical information (TG Three). COSATI influence has resulted in the development of a list of subject categories, a list of standard corporate authors, a draft standard for bibliographic descriptions, and guidelines for standards for report preparation as well as surveys of data activities and information analysis centers.[17] Analogous to the organizations in the private sector, COSATI is not empowered to require compliance with the standards or recommendations of its panels or groups. In both sectors, however, voluntary interaction seems to be inducing changes toward compatibility that, though slower moving than might be achievable through edict, are likely to result in more universally acceptable techniques and practices that may be more adaptable to future modifications. The changes are also undoubtedly being triggered by the

spotlighting of deficiencies that self-interest suggests be corrected.

That collaborative planning, though time consuming, can be richly rewarding is exemplified in the effort known as the MARC (MAchine Readable Cataloging) Project. This began in 1964 with a contract from the Council on Library Resources to Inforonics, Inc., to study possible methods of converting the information on Library of Congress (LC) catalog cards to machine-readable form so that bibliographic products could be printed by computer. By the close of 1965, a combined contract and in-house undertaking was in progress that included the experimental distribution of magnetic tapes to sixteen libraries (special, Government, State, university, public, and school) that were willing to evaluate the utility of the tapes. The character set (8-bit expanded ASCII, see Figure 10), the MARC II format, and computer program specifications are the products of collaboration, not only with the participating libraries (increased in 1968 to twenty), but also with representatives of interested and affected groups (e.g., the Machine Readable Cataloging Format Committee of the American Library Association, the Automation Committee of the Association of Research Libraries, the U.S. National Libraries Task Force on Automation and Other Cooperative Services, and COSATI).[18] MARC II tapes for English-language monographs are now available on subscription. To study the problems of converting existing records to machine-readable form, LC again convened a broadly representative group. The group recommended giving first priority to English-language monograph records issued from 1960 to date and second priority to Romance and German language monograph records for the same period.[19]

Because of the interaction that occurred during the MARC development, the enterprise became more than one solely to produce machine-readable records. It became the vehicle for establishing standards for the representation of bibliographic descriptions that are fundamental to record sharing and network building. Although MARC II has been designed for the transmission of bibliographic data, the MARC system is based on a modular concept to permit increasingly sophisticated modifications. The system presently consists of four major subsystems: (1) input, (2) storage, (3) retrieval, and (4) output. For information-retrieval elaborations, the extraction of high-use data elements and the construction of indexes for searching are anticipated. This may result in a contraction of the subsystems to input/output and storage/retrieval. The impact of the MARC project is evident also among processors of the report literature, for example, members of NFSAIS and ASIDIC, who are studying the applicability of the MARC format and programs to their own requirements.

Voluntary cooperation analogous to that experienced by LC has long marked the work of the National Bureau of Standards (NBS) with industry and other Government laboratories in the development of standard measurement units and techniques and testing procedures. In 1963, a National Standard Reference Data System (NSRDS) program was initiated in NBS to coordinate a variety of projects involving the compilation of critically evaluated physical property data.[20] Although the projects continue in their respective Government, industry, and university installations, the effect of a coordinating focal point is evident in the stimulus the NBS Office of Standard Reference Data (OSRD) has provided for the publication of compilations and critical reviews,

the clarification of concepts of "critical," "standard," and "reference" data, the identification of properties in need of study, and information exchange within the U.S. and abroad. As has occurred in other programs in which there has been broad participation, the NSRDS scope widened to include the preparation of such documentation aids as bibliographies and indexes and uncritical data compilations that began to be requested by users. The OSRD now includes a Data Systems Design and Development group that is developing guidelines for the preparation of computer programs for data handlers for storage and retrieval, file manipulation, and computer-assisted text preparation, editing, and printing.[21] A General Purpose Scientific Document Image Code (GPSDIC) has been devised by the NBS Physical Chemistry Division under OSRD sponsorship that is compatible with the American National Standards Institute (ANSI) Standard Code for Information Interchange (ASCII) that, as noted above, is needed to facilitate machine processing and exchange.[22] GPSDIC specifications incorporate planned dissemination via magnetic tape and telecommunication links, applicability to extended character high-speed line printers, and use of the machine record as typescript input to computerized typesetting programs.

By 1966, a survey of the Special Libraries Association and the American Library Association disclosed a significant trend in academic, public, and Government libraries toward mechanization of various functions (see Figure 11).[23] Several libraries have joined forces to determine the feasibility of single systems that might serve the needs of a library community.

One of the most ambitious of these enterprises is the Biomedi-

cal Communication Network that links the State University of New York (SUNY) biomedical libraries on the Buffalo, Syracuse, Albany, Brooklyn, and Stony Brook campuses, the University of Rochester Medical Center Library, the Albany Medical College Library, and the National Library of Medicine (NLM).[24] The system is being designed for on-line searching of a data base consisting of ten years of book catalog data from the participating libraries and five years of NLM-produced MEDLARS (MEDical Literature Analysis and Retrieval System) data. Current projects include the preparation of a State university-wide union list of serials, the development of shared cataloging programs with the NLM and the Countway Library of Medicine, and the formulation of a query language and procedures similar to those of programmed-instruction texts for direct user interrogation of stored information through remote terminals. Extensions are planned for the automation of on-line acquisition and cataloging procedures and circulation control. IBM DATATEXT has been used in an initial conversion of NLM Current Catalog data to the MARC format. The network is being sponsored by NLM.

The Library Systems Development program of Columbia University, Stanford University, and the University of Chicago evolved from discussions among the principals about their individual activities. Columbia, sponsored by NSF, is developing subsystems for several processing functions with the objective of integrating them into a total processing system. Chicago, also with NSF sponsorship, is constructing a bibliographic data processing system for acquisitions and circulation control. Stanford, with Office of Education support, is studying the incorporation of typewriter and visual display terminals on-line in an integrated bibliographic control system (BALLOTS, Bib-

liographic Automation of Large Libraries on Time-Sharing). The three have focused on acquisitions and fund accounting in their collaborative effort and have produced a comprehensive list of acquisition data elements.

Following a different developmental pattern, five libraries at state universities in Connecticut, Massachusetts, New Hampshire, Rhode Island, and Vermont are interconnected by a teletype network to an experimental computer installation operated by a private firm, Informonics, Inc., in Massachusetts. The network, called NELINET (New England Library Information Network), has been sponsored by the Council on Library Resources since 1966. The objective is to build a computer-based regional center for technical services, particularly for book processing and circulation control that constitute the most expensive and complex part of library administration. The book cataloging subsystem has been coordinated with MARC; present computer capacity is expected to be able to accommodate up to 64 libraries in the region in the near future.

Similarly, the System Development Corp. (SDC) is testing its LISTS (Library Information System Time-Sharing) programs in the environment of the Southern California region.[25] The experiment is a study of the economic feasibility of applying modified general-purpose programs to the on-line performance of library processing tasks in small to moderate-size public and academic libraries as well as to SDC's industrial-type library. LISTS has subsystems for monograph acquisition, cataloging, circulation management, and serials control. All participants have planned some acquisitions processing, but individuals will explore other routines appropriate to their own needs.

A recurrent theme in reports of collaboration and network building is the complexity that is usually encountered that neither librarians, system analysts, nor computer specialists have fully anticipated. More time is frequently needed in preliminary phases to arrive at a mutual understanding among participants of the operations and organizations that are to be involved. Only through working experience can tasks sometimes become clarified and needed qualifications of staff revealed. Computer software costs are often difficult to estimate and are frequently underestimated by wide margins. Suboptimum tradeoffs must be introduced because of fund shortages. People's adaptation to the new and novel is often so rapid that users engaged in tests of pilot systems tend to forget that they are experimental in their expectations of polished data bases and efficient computer programs.

Perhaps exceeding all other difficulties is that posed by the need for teamwork among individuals of different specializations whose relationships with the total effort also differ. To many of the computer specialists who design and implement, the project is an assignment that will, in due course, be superseded by another. Librarians and information specialists, who will have to live with the finished product, are called on to specify untried procedures that should be operably appropriate to machines they know little or nothing about. Users place demands for output with no appreciation of the work required to obtain it. Conversely, system builders are not aware of what users need and why they need it. The information processing situation calls for a level of human interaction that is becoming generally recognized in other social contexts as essential for the achievement of modern-day goals.

While realism dictates that the undone be emphasized, there is also merit in drawing satisfaction from accomplishments. The above account provides many bases for such satisfaction.

STANDARDS

Some standards have communication value not too dissimilar from that of a language. Like a language, they can impede objectives or they can embody flexibilities that not only facilitate their use but also enable their own enrichment. Because of potential restrictive effects, the establishment of standards usually proceeds sometimes all too slowly for those who wish to use them.

As indicated above, character set and magnetic-tape formats for bibliographic citations, mathematical formulas, and scientific symbols would facilitate the exchange of machine-readable records among computer centers whose equipment varies widely. These are not the only areas in which standardization would be beneficial for information processing. Areas that have been identified as appropriate for standardization study by the American National Standards Institute (ANSI) Standards Committee Z39 for "Library Work, Documentation and Related Publishing Practices" and Standards Committee X3 for "Computers and Information Processing" are reflected in subcommittee names listed in Figures 12 and 13.[26] The activities of these Committees are supported, respectively, by matching grants from the Council on Library Resources and NSF (for Z39) and by the Business Equipment Manufacturers Association (for X3). Potential areas of conflict are self evident, and ANSI has been asked to redefine the scopes of these Committees in conjunction with those of PH5 ("Photographic Reproduction of Documents"),

X4 ("Office Machines"), and Z85 ("Library Equipment and Supplies").

Prominent among the standards that have been issued is X3.4-1968, the USA Standard Code for Information Interchange (ASCII). The work of Task Group X3.2G on the development of standard codes for representing text in forms suitable for text editing, text processing, information retrieval, and automated typesetting is exemplary of continuing activity to formulate codes based on the Standard Code. Standards produced by Z39 subcommittees that are presently available from ANSI include:

Z39.1-1967	Periodical: Format and Arrangement
Z39.4-1968	Basic Criteria for Indexes (rev. of Z39.4-1959)
Z39.5-1963	Periodical Title Abbreviations (Z39.5-1969 is in the final approval stage)
Z39.6-1965	Trade Catalogs, Specifications for
Z39.7-1968	Library Statistics
Z39.8-1968	Compiling Book Publishing Statistics[27]

Z39.5-1969, Bibliographic Information Interchange on Magnetic Tape, is in the final approval stage.

Individuals representing a broad spectrum of interests and institutions participate in standards work in the United States. Additionally, groups within many professional societies, including the Association for Computing Machinery, the American Federation of Information Processing Societies, and the American Society for Information Science are independently and collaboratively debating such issues as the definition of data elements and tape formats. Standardization of data elements and codes is also in progress within the Government under the aegis of the Bureau of the Budget with the consultative assistance of the NBS.

The picture is replicated on the international level through such institutions as the International Standards Organization (ISO) in which ANSI represents the United States. The Abstracting Board of the International Council of Scientific Unions (ICSU/AB) is charged with establishing the standards that ISO issues. Numerous observer organizations that send representatives to deliberations include the International Federation for Documentation (FID), the International Federation of Library Associations (IFLA), the ICSU Committee on Data for Science and Technology (CODATA), the UNESCO International Advisory Committee on Documentation, Libraries, and Archives, and the Technical Information Panel of AGARD (NATO's Advisory Group for Aerospace Research and Development). Currently, UNISIST, a body created by ICSU and UNESCO to examine the feasibility of a world science information system, is also concerned with standardization.

A great amount of inertia, frustration, and delay is inevitably attendant on such broad and sometimes diffuse participation. Just as ad hoc information retrieval systems have had to be installed while principles of effective system design were being investigated in research laboratories (and still are being investigated), information tapes are being produced and hardware is being built according to the best judgment of their creators. Pressure is growing, however, for more standards that can be incorporated into machine-readable records and into hardware and software designs. This may accelerate future standards development. The existence of standards should have the effect of reducing a variety of production costs that should then reduce processing costs. As language changes over time, so can (and have) standards. This may be a useful perspective for standards de-

velopers.

TRENDS

Since a selection has been made in this paper of current trends pertaining to information-handling activities in the United States, an attempt is made here both to summarize those that have been discussed and to enlarge the picture.

1. A variety of information products are beginning to be explored and marketed, both under Government and private sponsorship. These are the "third-level services" encouraged by the SATCOM Committee. A danger exists that they are becoming duplicative, at least in populated subject fields.

2. The number of commercial and not-for-profit (mostly university) information service facilities is increasing. The forte of commercial enterprises is often the expertise of their staffs either in system design and data-base management or in information-product development. The trend in universities is toward the acquisition of available data bases and interdepartmental networking to establish clienteles for customized information products.

3. Cooperative and collaborative endeavors are mushrooming. Most of these are alliances among groups having common interests as to function or subject area or both. Thus, NFSAIS represents secondary-service producers, ASIDIC third-level service centers, IIA commercial information firms, COSATI Government agencies, the MARC network library users of LC tapes, and the SUNY network biomedical libraries. Exchange of information among the groups is occurring through overlapping institutional and individual memberships.

4. A growing emphasis on computer processing, at least of bibliographic data elements, is creating pressure for format standards and program interchangeability. Most professional societies and associations have formed working groups in one or both of these areas that are in liaison with each other, and members participate on subcommittees of ANSI committees.

5. Parochialism persists with communalism, perhaps because plans for data-base reassessment and sharing are in such formative stages that no changes in operation can realistically be considered at the present time. Nevertheless, there seems to be less impetus toward implementing joint ventures among groups in all information-handling communities than statements of plans would suggest.

6. Concentration on computer processing has tended to obscure consideration of the quality of what is being processed. While standardized formats and program interchangeability are undeniably important issues, the present non-interchangeability of subject vocabularies, the absence of thesaural guides, indexing inconsistencies and inadequacies, and the lack of abstracts and nonuniform quality of those that exist are equally important issues, at least from the user's point of view. These latter issues may not be as easy to contend with, but they will have to be faced eventually, particularly as users become more sophisticated in their awareness of what they receive vs. what they could receive.

7. Except at a few universities, little progress has been made in the development of information science and library science curricula that reflect current knowledge about information handling. This seems less due to a teacher shortage than to individual or institutional

indetermination and hesitance to adapt to change.

8. Some theoretical foundations and considerable practice gained during the 1960's have matured the field of information handling to the point where much solid research can now be done. As mentioned in the SATCOM report, some of this research should be large scale and, because much of it should involve the teamwork of individuals from several specialties, it will be costly. At this crucial time, research funds seem to be dwindling.

9. Although an orientation to user needs has been said to be the raison d'être for many information products, little study showing the application of behavioral science principles to information-handling phenomena has, as yet, been conducted. Much information product and service work might be aided by an understanding of how the user behaves and how he might be induced to behave.[28] Moreover, characteristics of the user bear on the flow and transfer of information and on how it is and can be exploited as a commodity. Establishment of rapport between the information and behavioral sciences appears worth investigating in the 1970's.

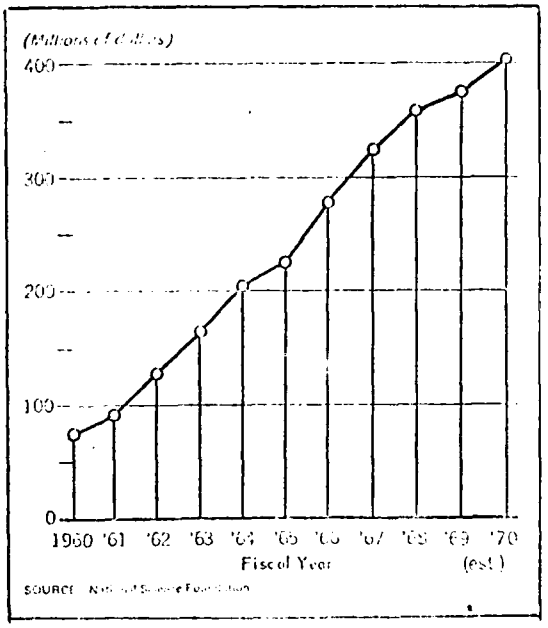


Figure 1. Trends in Federal Obligations for Scientific and Technical Information Activities (NSF Chart 20)

(Millions of dollars)

	Total obligations	Percent share
Total, all agencies	$576	100.0
Department of Defense	164	41.0
Department of the Army	71	18.8
Department of the Air Force	31	8.3
Department of the Navy	16	4.7
Defense Agencies	35	9.2
Department of Health, Education, and Welfare	69	18.5
National Institutes of Health (Incl. National Library of Medicine)	41	10.6
Office of Education	13	3.6
Health Services & Mental Health Adm.	8	2.0
Consumer Protection & Environmental Health Service	7	1.9
Department of Commerce	52	13.9
Patent Office	41	10.8
National Bureau of Standards	9	2.4
Environmental Science Services Adm.	2	0.6
National Aeronautics and Space Administration	26	7.0
Library of Congress	20	5.3
Department of the Interior	15	3.9
Geological Survey	7	1.9
Other subdivisions	8	2.0
National Science Foundation	13	3.5
Department of Agriculture	9	2.5
National Agricultural Library	4	1.0
Other subdivisions	5	1.5
Veterans Administration	5	1.5
Atomic Energy Commission	5	1.3
Department of Transportation	3	0.8
Smithsonian Institution	2	0.5
Department of State	2	0.5
Other agencies	1	0.4

Figure 2. Federal Obligations for Scientific and Technical Information, by Agency, FY 68 (NSF Table 30)

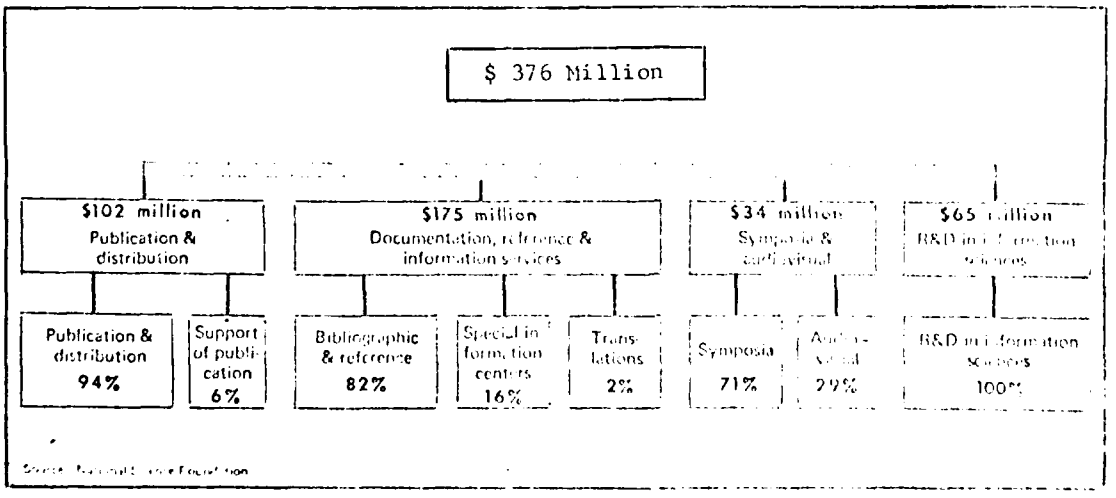
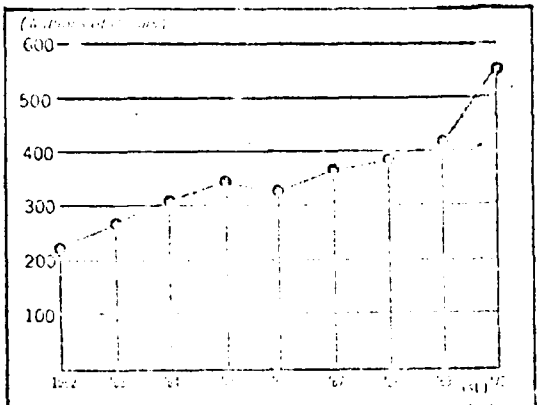


Figure 3. Federal Obligations for Scientific and Technical Information, by Activity, FY 1968(est.), (NSF Chart 21)



Year	Obligations (millions of dollars)	Annual percent change
1962	$220	—
1963	268	22
1964	309	15
1965	343	11
1966	325	−5
1967	368	13
1968	380	3
1969 (est.)	406	7
1970 (est.)	550	36

SOURCE National Science Foundation

Figure 4. Federal Obligations for Collection of General-Purpose Scientific Data, FY 1962-70 (NSF Chart 22)

Agency	Actual 1968	Estimates 1969	Estimates 1970
Total (millions of dollars)	$380	$406	$550
	Percent distribution		
Department of Commerce	44	44	48
Bureau of the Census	(9)	(10)	(30)
Environmental Science Services Administration	(35)	(34)	(29)
Department of Defense	19	19	15
Department of the Navy	(17)	(18)	(14)
Department of the Interior	12	12	9
Geological Survey	(11)	(11)	(8)
Department of Agriculture	9	9	7
Soil Conservation Service	(6)	(5)	(4)
Statistical Reporting Service	(4)	(4)	(3)
Department of Labor	5	5	4
Bureau of Labor Statistics	(5)	(5)	(4)
Department of Health, Education, and Welfare	8	8	8
Office of Education	(1)	(1)	(1)
Health Services & Mental Health Administration	(2)	(2)	(2)
All other agencies	8	8	6

Figure 5. Federal Obligations for Collection of General-Purpose Scientific Data, by Agency and Subdivision, FY 1968-70 (NSF Table 31)

FEE SCHEDULE

3i COMPANY | INFORMATION INTERSCIENCE INC.
Philadelphia, Pa. 19103

DATA BASE	MONTHLY FEE
Excerpta Medica "Drugdoc"	$ 1,000
Excerpta Medica Biomedical (without Drugdoc)	1,000
Excerpta Medica Total	1,500
Chemical Abstracts Service Includes Chemical Titles, CA-Condensates, Basic Journal Abstracts, Chemical-Biological Activities, & Polymer Science & Technology	500
Engineering Index "Compendex"	400

PROCESSING CHARGES	
1. For each issue of each data base file scanned	$ 5 per profile unit
2. For each hit in excess of 20 per profile unit per data base file issue (computed in the aggregate)	5¢
3. For retrospective searches:	
Routine service	$ 3 per computer minute
Priority service	$ 7 per computer minute

Figure 7. 3i Fee Schedule for Data Base Scanning Services

AUERBACH Standard EDP Reports
☐ Ten volumes, includes scientific and control computer reports. Updated monthly. $1200.00 initial year, $990.00 per year renewal.

AUERBACH Scientific and Control Computer Reports
☐ Three volumes, updated bi monthly. $390.00 initial year, $320.00 per year renewal.

AUERBACH Standard EDP Reports
☐ Eight volumes, covering all but scientific and control computer reports. Updated monthly. $900.00 initial year, $750.00 per year renewal.

AUERBACH Data Handling Reports
☐ Two volumes, updated quarterly. $325.00 initial year, $250.00 per year renewal.

AUERBACH Computer Notebook
☐ One volume, updated monthly $190.00 initial year, $175.00 per year renewal.

AUERBACH Software Notebook
☐ One volume, updated bi-monthly. $335.00 initial year, $315.00 per year renewal.

AUERBACH Graphic Processing Reports
☐ Two volumes, updated quarterly. $385.00 initial year, $315.00 per year renewal. Initial delivery January 1969.

AUERBACH Data Communications Reports
☐ Two volumes, updated quarterly. $325.00 initial year, $275.00 per year renewal.

Figure 8. Information Products of Auerbach Info, Inc., Philadelphia, Pa. 19107

NATIONAL FEDERATION OF SCIENCE ABSTRACTING AND INDEXING SERVICES

MEMBER SERVICE STATISTICS, 1957-1970

	1957	1962	1967	1968	1969	ESTIMATE 1970
Abs. of Photo. Sci. Eng. Lit.	----	2,013	3,593	3,[illegible]	2,[illegible]	[illegible]
AIP Information Store	----	----	----	----	20,000	25,000
American Petroleum Inst.	----	----	29,000	28,[illegible]00	30,000	33,000
Applied Mechanics Reviews	4,245	7,000	8,[illegible]	9,[illegible]26	10,[illegible]	[illegible]
Bibliog. & Index of Geology (AGI)	----	6,[illegible]50	11,[illegible]70	17,[illegible]89	17,[illegible]07	[illegible]
Biological Abstracts	49,661	101,[illegible]38	125,[illegible]61	21[illegible],[illegible]00[b]	22[illegible],[illegible]24	2[illegible],[illegible]00
Chemical Abstracts	101,027	149,165	233,[illegible]11[a]	25[illegible],[illegible]76[c]	28[illegible],[illegible]38[c]	30[illegible],[illegible]00[c]
Computer & Control Abstracts (IEE)	----	----	6,804	7,311[d]	13,[illegible]86[d]	17,000[d]
Electrical & Electronics Abstracts (IEE)	6,451	15,038	24,[illegible]39	30,[illegible]39[d]	45,766[d]	50,000[d]
Engineering Index Monthly	26,300	45,000	56,[illegible]50	61,291	58,[illegible]00	65,[illegible]00
Geo Ref. & Engineering Co.	25,000	35,000	10,[illegible]00[e]	5,[illegible]00[e]	3,[illegible]00[e]	3,[illegible]00[e]
Information Science Abstracts (DAI)	----	----	1,397	1,[illegible]71	2,[illegible]63	3,600
Mathematical Reviews (AMath)	9,730	13,382	17,[illegible]41	15,179	21,[illegible]16	17,000
Medical Documentation Service	----	----	1,[illegible]02	1,[illegible]31	3,[illegible]02	3,500
Metals Abstracts (ASM)	8,219	11,[illegible]42	23,[illegible]00	23,[illegible]47	25,031	26,000
Meteorological & Geophysical Abs (AMets)	5,000	12,000	9,[illegible]00	9,[illegible]29	9,550	10,[illegible]00
Oral Research Abstracts (ADA)	----	----	6,[illegible]81	7,[illegible]56	7,180	7,[illegible]00
Psychological Abstracts (APA)	9,074	8,776	17,[illegible]02	19,[illegible]96	18,[illegible]49	17,[illegible]00
TOTAL:	234,577	436,[illegible]74	581,[illegible]98	706,[illegible]66	776,[illegible]71	852,[illegible]00

Notes:

a Major publication only; does not include subsidiary publications.
b Includes BA and BioI.
c These data include duplicate patents referenced to the abstract in CA through the CA Patent Concordance.
d IEEE joined the Federation in 1969. They became joint publishers with the Institution of Electrical Engineers (U.K.) of EEA in 1968 and of CCA in 1969 (formerly Control Abs.)
e Decreases over the years have resulted from shifts in internal publications to equivalent bulletins published outside, chiefly by the American Petroleum Institute.

Abbreviations:

ADA - American Dental Association
AGI - American Geological Institute
AMat S - American Mathematical Society
AMet S - American Meteorological Society
APA - American Psychological Assoc.
ASM - American Society for Metals
DAI - Documentation Abstracts, Inc.
IEE - Institute of Electrical Engr., London

Figure 9. NFSAIS Membership and Literature Volume Statistics

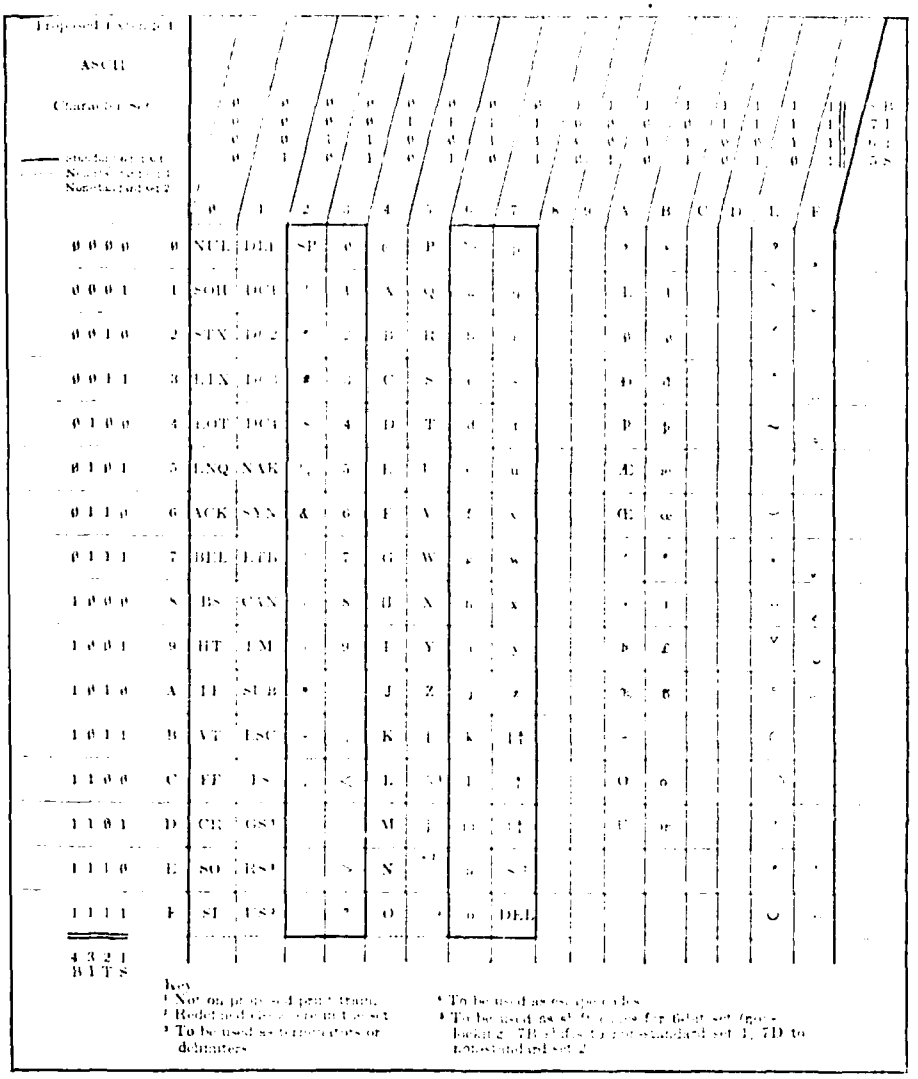


Figure 10. LC Proposed Extended USA Standard Code for Information Interchange (ASCII)

	Users	Planners	Total	% of 1,130 Inst.
Serials control	209	242	451	40
Circulation control	165	241	409	36
Accessions lists	170	220	390	34
Accounting	235	111	346	31
Acquisitions	102	226	328	29
Book catalog production	125	201	326	28
Retro searches—doc. retr.	131	156	287	25
Union lists	133	123	256	23
Catalog card production	101	139	240	21
KWIC indexes	135	98	233	20
Current awareness service	91	137	228	20
Retro searches—data retr.	66	105	171	15
Interlibrary communications	71	90	161	14
Other functions	99	44	143	12
Microform materials	48	81	129	11
Classified document control	57	52	109	9
	1,938	2,269	4,207	

Figure 11. Library Functions Mechanized in Order of Frequency (1966 Data)

AMERICAN NATIONAL STANDARDS INSTITUTE, INC.

SUBCOMMITTEES OF STANDARDS COMMITTEE Z39

for Library Work, Documentation, and Related Publishing Practices

SUBCOMMITTEE		CHAIRMAN
SC/1	Program	James L. Wood, Chemical Abstracts Service
SC/2	Machine Input Records	Henriette D. Avram, Library of Congress
SC/3	Periodical Title Abbreviations	James L. Wood, Chemical Abstracts Service
SC/4	Bibliographic References	Maurice Tauber, Columbia University
SC/5	Transliteration	Jerrold Orne, University of North Carolina
SC/6	Abstracts	Ben H. Weil, Esso Research & Engineering Co.
SC/7	Library Statistics (now on standby)	
SC/8	Proof Corrections	Bruce Young, University of Chicago Press
SC/9	Terminology	Jerrold Orne, University of North Carolina
SC/13	Trade Catalogs and Directories	Karl Baer, National Housing Center
SC/17	Standard Book Numbering	Robert W. Frase, American Book Publishers Council Emery Koltay, R. R. Bowker Co.
SC/19	Book Publishers Advertising	Ellis Mount, Columbia University
SC/20	Standard Serial Coding	Fred Croxton, Information Disco, Inc.
SC/21	Title Leaves of a Book	Anne J. Richter, R. R. Bowker Co.
SC/22	Library Materials Price Indexes	William H. Kurth, Washington University
SC/24	Report Literature Format	Jack W. Grewell, Federal Aviation Administration
SC/25	Thesaurus Rules and Conventions	Frank Y. Speight, Engineers Joint Council
SC/26	Preparation of Scientific Papers	F. Peter Woodford, Rockefeller University
SC/27	Identification Codes for Countries, Languages, Publishers, Areas & Dates	Patricia E. Parker, Library of Congress
SC/28	Guide for Referees of Journal Articles	Karl Heumann, Federation of American Societies for Exptl. Biology
SC/29	Publicity and Promotion	James I. Olsen, Jr., National Academy of Sciences
SC/30	Identification Code for Libraries	David Taylor, Washington State University

Figure 12. Active Subcommittees of ANSI Standards Committee Z39
January 1970

AMERICAN NATIONAL STANDARDS INSTITUTE, INC.

SUBCOMMITTEES OF STANDARDS COMMITTEE X3

for Computers and Information Processing

SUBCOMMITTEE	CHAIRMAN
3.1 Optical Character Recognition	
3.2 Codes and Input Output	
3.2.6 Codes for Textual Data	B. C. Duncan, National Bureau of Standards
3.3 Data Communication	
3.4 Common Programming Languages	
3.5 Terminology and Glossary	
3.6 Problem Definition and Analysis	
3.7 Magnetic Ink Character Recognition	
3.8 Data Elements, Codes and Formats	Harry S. White, Jr., National Bureau of Standards
3.8.1 Criteria for Data Standardization	Arthur E. Blum, American Institute of Physics
3.8.2 Time Designations	
3.8.3 Identification of Individuals and Organizations	
3.8.4 Geographic Units	
3.8.5 Data Formats	Howard Tompkins, Inst. of Electrical & Electronic Engrs.
3.8.6 Quantitative Expressions	
Ad Hoc 1 Input/Output Interfaces	
Ad Hoc 2 Data Descriptive Languages	

Figure 13. Partial List of Subcommittees and Task Groups of ANSI Standards Committee X3, June 1969

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Security Classification

DOCUMENT CONTROL DATA - R & D

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13. ABSTRACT

This paper discusses several of the trends in information handling for text-based storage and retrieval systems that are prevalent in the United States. The paper considers, in particular, specialized information products, cooperative and networking activities, and work on standards. Information products include current awareness abstract bulletins in selected subject fields, computer-generated indexes and bibliographies in selected fields, scientific paper distribution services in selected fields, special-interest thesauri, newsletters employing newspaper-style reporting for alerting purposes, microcard and microfilm aperture card distribution services, and on-line access to computer-stored information bases. The number of commercial and not-for-profit (mostly university) information service facilities is increasing. Most of the cooperative endeavors are alliances among groups having common interests as to function or subject field or both. The growing emphasis on computer processing, at least of bibliographic data elements, is accelerating the development of format standards and computer program interchangeability. Concentration on computer processing seems to be obscuring consideration of the quality of the information being processed. The present state-of-the-art suggests the readiness for basic research, some of it large-scale over an extended period of time, as proposed in the IFQ'N report. Greater use of behavioral science knowledge and methods is suggested in studies of user behavior and information flow and transfer.

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Security Classification

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Information storage and retrieval						
Information system networks						
Information products						
Standards						
SATCOM report						
Current awareness						
Special-interest profiles						
Computer-based information retrieval systems						
Computer-produced indexes						
Abstracting and indexing services						

Security Classification